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Prevalence of Advanced, Precancerous Colorectal Neoplasms in Black and White Populations: A Systematic Review and Meta-analysis

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Running Title: Advanced Colorectal Neoplasia in Blacks and Whites

Word count (abstract): 245
Word count (main text): 2492
Word count (main text; references; table/figure legends): 4760
Number of figures: 3
Number of tables: 3
Number of tables in appendix: 1

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The authors report no conflicts of interest.

Author contributions to manuscript:
Study conception: TI
Obtained funding: TI
Data collection: PA, TE, TI
Data abstraction: PA, TI
Technical, or material support: TI
Study quality assessment: PA, TI
Analysis: TS
Drafting of the article: TI
Editing of the manuscript: all
Final approval of the manuscript: all
Study supervision: TI

This is the author's manuscript of the article published in final edited form as:
Imperiale, T. F., Abhyankar, P. R., Stump, T. E., & Emmett, T. W. (2018). Prevalence of Advanced, Precancerous Colorectal Neoplasms in Black and White Populations: A Systematic Review and Meta-analysis. Gastroenterology. https://doi.org/10.1053/j.gastro.2018.08.020

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Funding Source: This project was supported by Indiana CTSI Collaboration in Translational Research Grants (Grant #UL1TR001108)

Abstract:

Background & Aims: Colorectal cancer (CRC) incidence and mortality are higher in black vs white populations. The reasons for these disparities are not clear, yet some guidelines recommend screening black persons for CRC starting at ages 40–45 years. We performed a systematic review and meta-analysis to compare the prevalence of advanced adenomas (AAs) and advanced, precancerous colorectal neoplasms (ACNs) between asymptomatic black and white screen-eligible adults.

Methods: We searched Ovid MEDLINE, PubMed, Embase, and the Cochrane Library to identify articles (published from 1946 through June 2017) that reported prevalence values of AA or ACN in average-risk black and white individuals undergoing screening colonoscopy. Two authors independently assessed study quality and risk for bias using a modified validated quality assessment instrument. Following the PRISMA guidelines, 2 authors independently abstracted descriptive and quantitative data from each study. We performed a random effects meta-analysis to determine risk differences and odds ratios (ORs).

Results: From 1653 articles, we identified 9 studies for analysis, comprising 302,128 individuals. Six of the 9 studies were of high methodological quality, had a low risk for bias, and were included in the meta-analysis. In these 9 studies, the overall prevalence values for AA and ACN did not differ significantly between back (6.57%) and white screened individuals (6.20%; OR, 1.03; 95% CI, 0.81–1.30). Among a subgroup of 5 studies, the prevalence of proximal AA and ACN was significantly higher in black (3.30%) than in white screened individuals (2.42%; OR, 1.20; 95% CI, 1.12–1.30). Excluding the largest study did not affect overall prevalence (OR, 0.99; CI, 0.73–1.34) but eliminated the difference in prevalence of proximal AA or ACN (OR, 1.48; 95% CI, 0.87–2.52).

Conclusions: In a meta-analysis, we found the overall prevalence of AA and ACN did not differ significantly between average-risk black and white persons, indicating that the age at which to begin CRC screening need not differ based on race.

Key words: colon cancer; incidence; ethnicity differences; colonoscopic detection

INTRODUCTION

Although colorectal cancer (CRC) is the third most common cancer and the second-leading cause of cancer death in the U.S. among all racial/ethnic groups, higher CRC incidence and mortality rates are found among Black adults.[1] In 2014, the U.S. incidence of colorectal cancer was 50.4 per 100,000 for Black men, as compared with 43.0 per 100,000 for White men [2]. Incidence rates were lower for women, but were higher for Black women (38.9 per 100,000 versus 32.8 per 100,000 for White women).[2] A similar discrepancy exists for CRC mortality: 23.1 per 100,000 for Black men vs.16.4 per 100,000 for White men, and 15.3 per 100,000 for Black women vs. 11.7 per 100,000 for White women.[2] Because of the higher incidence and mortality rates in Blacks, the American College of Gastroenterology and the U.S. Multi-Society Task Force on Colorectal Cancer recommend CRC screening beginning at 45 years for average-risk Blacks, while the American College of Physicians recommends starting at age 40, five to ten years earlier than for non-Blacks.[3-6] Several reasons for this racial disparity are offered. Some studies suggest genetic / biological differences, while others point to social, environmental, or behavioral differences, including disparities in rates of CRC screening.[7-9]

The immediate precursor to CRC is the advanced adenoma (AA), the current target lesion for screening.[3] AAs usually include an adenoma 1 cm or larger, or one with villous histology or high-grade dysplasia, regardless of size. This combination of findings is also referred to as advanced precancerous polyps or neoplasms and sometimes includes sessile serrated polyps 1 cm or larger. When AA or advanced, precancerous polyps are combined with CRC, the term “advanced colorectal neoplasia” or “advanced neoplasia” is used.

The published literature comparing AA prevalence in Blacks and Whites is inconsistent. A difference in AA prevalence between Blacks and Whites could lend support to biology / genetics

as a contributor to the incidence / mortality disparity, whereas no difference would suggest non-biological factors such as access to and uptake of screening, or behavioral or social differences in response to symptoms. The purpose of this systematic review was to compare the prevalence of AA or advanced, precancerous colorectal neoplasms (ACN) between Blacks and Whites.

METHODS

This study was conducted on the campus of Indiana University Purdue University at Indianapolis from May to August 2017 without the need for approval by the Institutional Review Board of Indiana University. We report methods and results consisted with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) format.[10]

Data Sources and Searches. A comprehensive search of the literature was performed by a medical librarian (TWE) using Ovid MEDLINE, PubMed, Embase, the full Cochrane Library, and ClinicalTrials.gov. Searches were performed in June 2017, and all databases were searched from inception. Bibliographies of relevant studies were reviewed for additional references. Search strategies for the four databases are displayed in the Appendix. Database-specific subject headings and keyword variants for each of the four main concepts – colorectal disease, precancerous conditions, and the black and white populations – were identified and combined. Results were limited to the English language.

Study Selection. We included studies measuring the prevalence of advanced adenomas (AA) or advanced colorectal neoplasia (CRC + AA) in average-risk Blacks and Whites undergoing screening colonoscopy.

Data Extraction and Quality Assessment. Two authors independently abstracted descriptive and quantitative information from the studies. Study quality and risk of bias were assessed using a modified version of the National Institute of Health's Quality Assessment Tool for Observational Cohort and Cross-Sectional Study.[11] This instrument was modified to make it more relevant for cross-sectional research, resulting in the need to assess each article for 9 of the instrument's 14 questions.[11] Thus, study quality could range from 0 to 9. Disagreements in ratings were resolved in discussion. The quality criteria for the modified tool are found in the first column of **Table 1**.

Data Synthesis and Analysis. Study homogeneity was quantified using the I^2 statistic, which quantifies the percent of variation across a group of studies that is due to heterogeneity rather than chance.[12] A random effects model was used to combine data on AA/ACN prevalence from individual studies using R software and metafor R package for meta-analysis.[13,14] Prevalence point estimates, and risk differences and odds ratios with 95% confidence limits were generated. A funnel plot and regression test for asymmetry for overall AA/ACN prevalence were generated to assess this body of literature for publication bias.[15] Prior to performing the analyses, we decided to include two subgroup analyses based on study design features. In one subgroup analysis, we would exclude the largest study for two reasons: 1) it was the largest study by far and was expected to have a large and numerically-important influence on aggregate risk estimates; 2) it was the only study without polyp histology. The second subgroup analysis would include the studies with highest study quality and lowest risk for bias

Role of the Funding source. The study was funded by the Indiana CTSI Collaboration in Translational Research Grants. The funding source had no role in the study's design, conduct of the review, or reporting.

RESULTS

A total of 1653 references were identified. After removal of 128 duplicates, 1525 unique titles and abstracts were reviewed. From 1525 titles, we excluded 1363 for various reasons (**Figure 1**) and reviewed 162 full text articles. Of the 162 articles, 153 were excluded (**Figure 1**), leaving 9 studies that met all inclusion criteria and no exclusion criteria.[16-24]

Descriptive characteristics of the 9 studies are shown in **Table 2**. The 9 articles included 302,128 participants and were published between 2010 and 2017. Individual study sample sizes ranged from 80 to 292,494. The objective of 7 studies was to quantify the prevalence of advanced adenomas in both racial groups. All studies were cross-sectional, 5 of which collected data prospectively.[16,19,21-23] Six studies involved single sites,[16-18,20-22] while the remaining three[19,23,24] were multisite studies, one of which[19] included 84 practices throughout the U.S. All study populations were average-risk. The criteria for advanced adenoma were comparable across studies except for the largest study, which used “polyp > 9 mm” without including polyp histology.[19] For this analysis, we assumed that all such polyps were advanced adenomas. One study did not provide a definition for advanced adenoma. Large serrated polyps were included in the definition of advanced adenoma in two studies.[20,23] All studies defined “proximal” as the splenic flexure and colon segments proximal to it. Six studies reported no differences in AA prevalence between Blacks and Whites, 1 study reported a higher AA prevalence in Whites, 1 study reported higher prevalence in Blacks, and 1 reported a higher prevalence of large polyps in Blacks.

Study quality was generally high, with scores between 7 and 9, out of a highest achievable score of 9 (**Table 1**). Six of 9 studies were of high methodological quality, with low-risk for

bias.[17-21,23] The three studies with high-risk for bias[16,22,24] did not adjust prevalence for age and sex, a critical feature for a valid comparative analysis.

Advanced adenoma (AA) / advanced colorectal neoplasia (ACN). Among the 9 studies, prevalence of AA/ACN ranged from 2% to 10% for Whites and 5% to 12% for Blacks (**Table 3**). Results of individual studies for AA/ACN are shown in **Figure 2a**. Only the study by Lieberman and colleagues,[19] for which no histology was available, showed a higher prevalence of AA/ACN in Blacks. The study by Schroy and colleagues[21] showed that Whites had a higher prevalence of AA/ACN. In aggregate, however, there was no difference in AA/ACN prevalence between Blacks and Whites, with respective point prevalences of 6.57% and 6.20%, an odds ratio of 1.03 (95% CI, 0.81-1.30) and absolute risk difference of 0.00 (95% CI, -0.01 to 0.02) (**Table 3**). The I^2 values indicate moderate heterogeneity among studies. These findings remained unchanged with the largest study[19] excluded and in the subgroup of 5 studies[17,18,20,21,23] ("best subset") in which the results in each individual study were adjusted for age and sex (**Table 3**). I^2 values for these two subgroups reflect low-to-moderate study heterogeneity.

Proximal AA/ACN. Among the 5 studies in which advanced proximal lesions were measured,[16,18,19,21,23] the prevalence ranged from 0% to 4% for Whites and from 2% to 9% for Blacks. Individual study results for proximal AA/ACN are shown in **Figure 2b**. Two[18,19] of 5 studies showed greater prevalence in Blacks, one of which was the study by Lieberman and colleagues.[19] In aggregate, due to the dominance of the Lieberman study, proximal AA/ACN was more common among Blacks, with point prevalences of 3.30% in Blacks and 2.42% in Whites, an odds ratio of 1.20 (95% CI, 1.12-1.30), and absolute risk difference of 0.01 (95% CI, 0.00 to 0.01). The I^2 test showed no study heterogeneity (0%). Exclusion of the Lieberman study increased heterogeneity to the low-to-moderate range and eliminated the difference in proximal AA/ACN prevalence, but with less precision: OR= 1.48; 95% CI, 0.87-2.52) and risk difference

of 0.007 (95% CI, -0.004 to 0.018). In the best subset of 3 studies [18,21,23], which had a moderate degree of heterogeneity, there was no difference in prevalence: OR=1.44 (CI, 0.84-2.49), risk difference of 0.006 (CI, -0.005 to 0.018) (**Table 3**). A funnel plot for overall prevalence of AA/ACN did not suggest publication bias (P=0.52) (Figure 3).

DISCUSSION

In this systematic review of 9 studies of screening colonoscopy involving more than 300,000 subjects, we found no difference in the prevalence of advanced precancerous neoplasia between Blacks and Whites. This main finding among all studies was maintained in subgroup analyses that excluded the largest study and included only the highest quality studies. Further, five of the studies examined differences in the prevalence of advanced, precancerous neoplasia in the proximal colon, among which Blacks had a higher prevalence – an absolute risk difference of 1% and a 1.20 times greater odds than Whites. This small difference was not maintained in subgroup analyses. Among all studies, the degree of heterogeneity by I^2 test ranged from none to moderate.

Our findings are consistent with most, but not all, of the previous studies on this topic. We applied specific inclusion and exclusion criteria to identify those studies in which colonoscopy was the screening modality used in average-risk Blacks and Whites. Study quality and risk for bias were assessed in a standard fashion using an adapted validated instrument and independent review by two study authors. Study quality was moderate to high, with only three studies having high-risk for bias resulting from lack of adjustment for demographic covariates of age and sex. The consistency of the quantitative findings for any advanced precancerous neoplasia suggest that the finding of no difference is robust. For proximal advanced precancerous neoplasia, the overall difference was clinically small and was not supported by

pre-specified subgroup analyses. In total, our findings indicate no differences in advanced, precancerous neoplasia between average-risk Black and White screen-eligible adults.

Our findings are consistent with those from a VA-based, multi-site, retrospective, cross-sectional analysis of nearly 91,000 Veterans, in which the prevalence of CRC was slightly higher in Blacks (1.5% vs. 1.4% in Whites; adjusted OR=1.29; CI, 1.11-1.51) but with no difference in prevalence of advanced adenomas between Blacks and Whites (9.0% vs. 9.4%, respectively; adjusted OR=1.00; CI, 0.94-1.07).[25] An analysis of CRC survival among Veterans extends the observation of "no difference" between Blacks and Whites, as Dominitz and colleagues compared outcomes in Black and White male veterans with a new diagnosis of CRC, finding no difference in rates of surgical resection, radiation, chemotherapy, or 5-year survival.[26] Finally, the Delaware experience of resolution of the disparity in CRC incidence and mortality as the CRC screening disparity closed nicely illustrates how equalizing CRC screening rates between Blacks and Whites eliminated differences in CRC incidence, disease stage, and mortality.[27]

This analysis has strengths and limitations that warrant comment. One strength is the large sample size, despite the fact that one study accounted for nearly 97% of the observations. Another strength is the specificity of the study selection process, which resulted in a clinically homogeneous body of literature for analysis that was low-to-moderate in its degree of statistical heterogeneity. Study quality was moderate to high, as determined by a validated instrument. Finally, the quantitative findings were consistent in subgroup analyses, suggesting robustness of the numerical findings. A limitation of this analysis is the lack of adjustment of prevalence estimates for age and race in three studies, covariates that may have created imbalance in prevalence estimates between Black and White subjects in these studies. As mentioned, however, results were stable in subgroup analysis, suggesting that any imbalances due to unadjusted demographic features were not clinically important. A second limitation was the

inability to adjust for other factors associated with CRC and/or advanced neoplasia such as BMI, cigarette smoking, certain medications (NSAIDs, aspirin, statins) and other behavioral features, as these factors could further confound prevalence estimates. Publication bias is a potential third limitation, which we believe is unlikely, as the funnel plot does not support it, and six of nine studies show no difference in AA/ACN prevalence between Blacks and Whites.

Based on our findings and those of other studies, a practical clinical issue is whether Blacks should be screened earlier than Whites, as some guideline organizations recommend.[3,4,28] We found no difference between Blacks and Whites in the prevalence of AN, largely comprised of advanced precancerous polyps, which is the precursor lesion for most CRC. Absence of a difference in AN prevalence suggests that the differences in CRC incidence and mortality are less likely due to biology and more likely due to behavioral or sociocultural differences in recognition of symptoms, need for diagnostic evaluation, and/or access to, acceptance or uptake of preventive services. Our findings, along with other studies on this topic,[17,29-33] suggests that the age at which to begin screening need not differ based on race, especially in settings where obstacles to care are mitigated. However, for settings in which access to care disfavors Blacks, beginning screening in Blacks prior to age 50 may help mitigate this disparity.

A final consideration is the recent recommendation by the American Cancer Society to start average-risk screening in everyone at age 45.[34] If this recommendation is followed broadly, it would lessen the clinical and policy implications of our findings. However, the uptake of this recommendation is yet to be determined, as it differs from those of all other professional organizations.[3-5]

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CONCLUSION

In conclusion, we found no difference in the prevalence of advanced precancerous neoplasia between average-risk, screen-eligible Blacks and Whites who underwent screening colonoscopy. Further, among the most rigorous studies, there was no difference in advanced neoplasia in the proximal colon. In areas without disparities in access to screening, our findings support eliminating the age difference at which to begin average-risk screening that is currently recommended by some guideline organizations, and beginning average-risk screening at age 50 regardless of race. To the extent that the advanced adenoma is the precursor lesion for CRC, tailoring the age at which to begin screening and how to screen based on race is not supported by our findings.

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Table 1. Quality Criteria and Risk of Bias for Included Studies

Quality Criteria	**Collazo, 2015** [16]	**Friedenberg, 2012** [17]	**Lebwohl, 2012** [18]	**Lieberman, 2014** [19]	**Mendelsohn, 2017** [20]	**Schroy, 2013** [21]	**Stein, 2010** [22]	**Wallace, 2016** [23]	**Xirasagar, 2014** [24]
Was the research question or objective clearly stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was the study population clearly specified and defined?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were all subjects selected or recruited from the same or similar populations (including the same time period)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were inclusion and exclusion criteria for the study prespecified and applied uniformly?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Was a sample size justification, power description, or variance and effect estimates provided?	No	Yes	No	No	No	Yes	No	No	No
Were age, sex, and race measured prior to the outcomes being measured?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were age, sex, and race clearly defined, valid, reliable, and implemented consistently?	Yes (self)	Yes (self)	Yes (self)	Yes (endoscopists)	Yes (not stated)	Yes (not stated)	Yes (not stated)	Yes (not stated)	Yes (not stated)
Were the outcome measures clearly defined, valid, reliable, and implemented consistently?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Critical: Were groups comparable at baseline* or were differences in age and sex adjusted?	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Point score:	7	9	8	8	8	9	7	8	7
Risk of bias:	high	low	low	Low	low	low	high	low	high

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Table 2. Descriptive Information from Included Studies

1st Author, Year (ref)	Study Objective	Study Design	Study Setting	Sample Size, n	Study Population	Primary Outcome	Covariates Adjusted For	Findings	Comments
Collazo, 2015 ([16])	Report yield of SC based on demographics	Prospective cross-sectional study	Single urban institution 2004 to 2011	37 Blacks and 43 Whites	Uninsured and underinsured average-risk patients, age ≥50 years, undergoing SC. Excluded: had a FOB test within past year, flexible sigmoidoscopy within 10 years, history of IBD, CRC, spoke languages other than English or Spanish	AA (an adenoma ≥1 cm in diameter, villous/tubulovillous histology, high-grade dysplasia, or cancer), PAA (splenic flexure)	None	No difference in AA or PAA prevalence	Small sample size, no adjustment for age and sex
Friedenberg, 2012 ([17])	Determine and compare yield of AA and proximal location	Retrospective cross-sectional study	Single urban institution 2007 to 2010	669 Blacks and 257 Whites	Average-risk, asymptomatic patients age 45 to 59 with a negative family history of CRC and complete SC with good/excellent preparation. Excluded: prior SC, colon adenomas, or IBD	AA (an adenoma >10 mm in diameter, villous features or high-grade dysplasia), proximal adenoma (splenic flexure)	Age, sex, BMI, tobacco use, regular aspirin use, statin use	No difference in AA prevalence	Comparison group of white patients age 45-49 was not available
Lebwohl, 2012 ([18])	Measure adenoma prevalence	Retrospective cross-sectional study	Single urban institution 2006 to 2010	591 Blacks and 3542 Whites	Patients ≥50 years undergoing first-time colonoscopy. Excluded: incomplete or prior colonoscopy, poor bowel preparation, personal history of polyps, indications of occult GI blood loss, anemia, history of neoplasia, IBD, FAP or HNPCC	AA (an adenoma ≥10mm in greatest diameter or exhibiting advanced histology such as villous, tubulovillous or high grade dysplasia), PAA (splenic flexure)	Age, sex, family history of colorectal neoplasia	Blacks have a higher prevalence of AA and PAA than Whites	29% of subjects were excluded due to missing data pertaining to race/ethnicity
Lieberman, 2014 ([19])	Measure prevalence of significant polyps based on demographics	Prospective cross-sectional study	84 practice sites in the US 2000 to 2011	17955 Blacks and 269160 Whites	Average-risk patients ≥40 years undergoing screening colonoscopy. Excluded: family history of CRC or polyps, positive FOB	Large polyps (polyps sized >9mm or described as a tumor); large proximal polyps (splenic flexure)	Age, sex	Blacks ≥50 have a higher prevalence of large polyps and large	No histology of polyps (poor surrogate of ACN), did not state how polyps were

					test, or any other lower GI symptoms			proximal polyps than whites	measured, endoscopist determined race
Mendelsohn, 2017 ([20])	Compare adenoma yield	Retrospective cross-sectional study	Single urban institution, time period not stated	191 Blacks and 199 Whites	Average-risk, underserved patients 40 to 69 years of age undergoing SC	Adherence to screening, any adenoma, AA (no definition given)	Age, sex, education, smoking, NSAID use, obesity	No difference in AA prevalence	Modest sample size, did not state how race was obtained
Schroy, 2013 ([21])	Define prevalence and location of ACN	Prospective cross-sectional study	Single urban institution 2005 to 2012	1681 Blacks and 1172 Whites	Asymptomatic, average-risk patients aged 50 to 79 undergoing SC. Excluded: prior polyps, family history of CRC, poor bowel preparation, or incomplete examination	Serrated lesions, ACN (a tubular adenoma ≥10mm, villous features or high-grade dysplasia, dysplastic serrated lesion of any size, or invasive cancer), proximal ACN (splenic flexure)	Age, sex, education, insurance, risk factors	Whites have a higher prevalence of ACN than Blacks. No difference in proximal ACN prevalence	Did not state how race was obtained
Stein, 2010 ([22])	Determine if BMI is associated with ACN in a diverse cohort	Prospective cross-sectional study	Single suburban site 2006 to 2007	67 Blacks and 356 Whites	Asymptomatic patients aged ≥40 years undergoing SC. Excluded: GI symptoms, prior history of colonic neoplasia, IBD, prior endoscopic screening in 10 years	ACN (large ≥1cm adenoma, villous adenoma (>25% villous, high grade dysplasia or cancer)	None	No difference in ACN prevalence	No adjustment for age and sex; did not state how race was obtained
Wallace, 2016 ([23])	Assess prevalence of large bowel polyps within a diverse population	Prospective cross-sectional study	Regional study 2011 to 2013	110 Blacks and 91 Whites	Uninsured, asymptomatic patients with no personal history of colorectal neoplasia between the ages 45 to 64. Excluded: unable to speak English or cognitively unable to provide informed consent	Serrated histology, AA (adenomas with at least 25% villous component, high grade dysplasia, or an estimated size of ≥1cm), PAA (splenic flexure)	Age, sex, clinical site	No difference in AA or PAA prevalence	Relatively small sample size and did not state how race was obtained

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Xirasagar, 2014 ([24])	Evaluate the racial disparities reduction potential of a program for indigent persons	Retrospective cross-sectional study	Multi-site urban site 2009 to 2010	465 Blacks and 163 Whites	Uninsured patients with income <200% of the federal poverty limit, age 45-64 years undergoing SC. Excluded: GI symptoms	ACN (adenoma ≥10mm, villous / tubulovillous features, high-grade dysplasia, or cancer)	None	No difference in ACN prevalence	No adjustment for age and sex. did not state how race was obtained

AA = advanced adenoma; PAA = proximal advanced adenoma; CRC = colorectal cancer; SC = screening colonoscopy; FOB = fecal occult blood; IBD = inflammatory bowel disease; HNPCC = hereditary non-polyposis colorectal cancer; BMI = body mass index; FAP = familial adenomatous polyposis

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Table 3. Summary of Study Results

Outcome	Study N	Subject N	Prevalence Range Blacks	Prevalence Range Whites	Prevalence Point Estimate Blacks	Prevalence Point Estimate Whites	Risk Difference (95% CI)	Odds Ratio (95% CI)	I^2 test Risk Difference (RD), Odds Ratio (OR)
AA/ACN									
All studies	9	296,749	5-12%	2-10%	6.57%	6.20%	0.00 (-0.01 to 0.02)	1.03 (0.81 to 1.30)	51.9% (RD) 55.9% (OR) Moderate
All studies except Lieberman 2014	8	9634	5-12%	2-10%	5.95%	6.11%	-0.001 (-0.183 to 0.017)	0.99 (0.73 to 1.34)	39.2% (RD) 44.5% (OR) Moderate
Best subset[†]	5	8503	5-12%	4-9%	5.78%	5.79%	0.002 (-0.018 to 0.022)	1.06 (0.75 to 1.50)	49.8% (RD) 53.5% (OR) Moderate
Proximal AA/ACN									
All studies	5	299,761	2-9%	0-4%	3.30%	2.42%	0.01 (0.00 to 0.01)	1.20 (1.12 to 1.30)	0% (RD) 0% (OR) Low
All studies except Lieberman, 2014	4	7267	2-9%	0-4%	2.64%	1.93%	0.007 (-0.004 to 0.018)	1.48 (0.87 to 2.52)	20.4% (RD) 38.0% (OR) Low to moderate
Best subset*	3	7187	2-9%	1-4%	3.57%	2.07%	0.006 (-0.005 to 0.018)	1.44 (0.84 to 2.49)	27.4% (RD) 47.4% (OR) Moderate

[†]Best subset includes references 17, 18, 20, 21, 23
*Best subset included references 18, 21, 23

Figure Legend

Figure 1. Study Selection Flow Chart
Figure 2: A. Forest Plot for Advanced Adenoma – All studies;
Figure 2: B. Forest Plot for Proximal Advanced Adenoma – All Studies
Figure 3: Funnel Plot for Advanced Adenoma – All studies.

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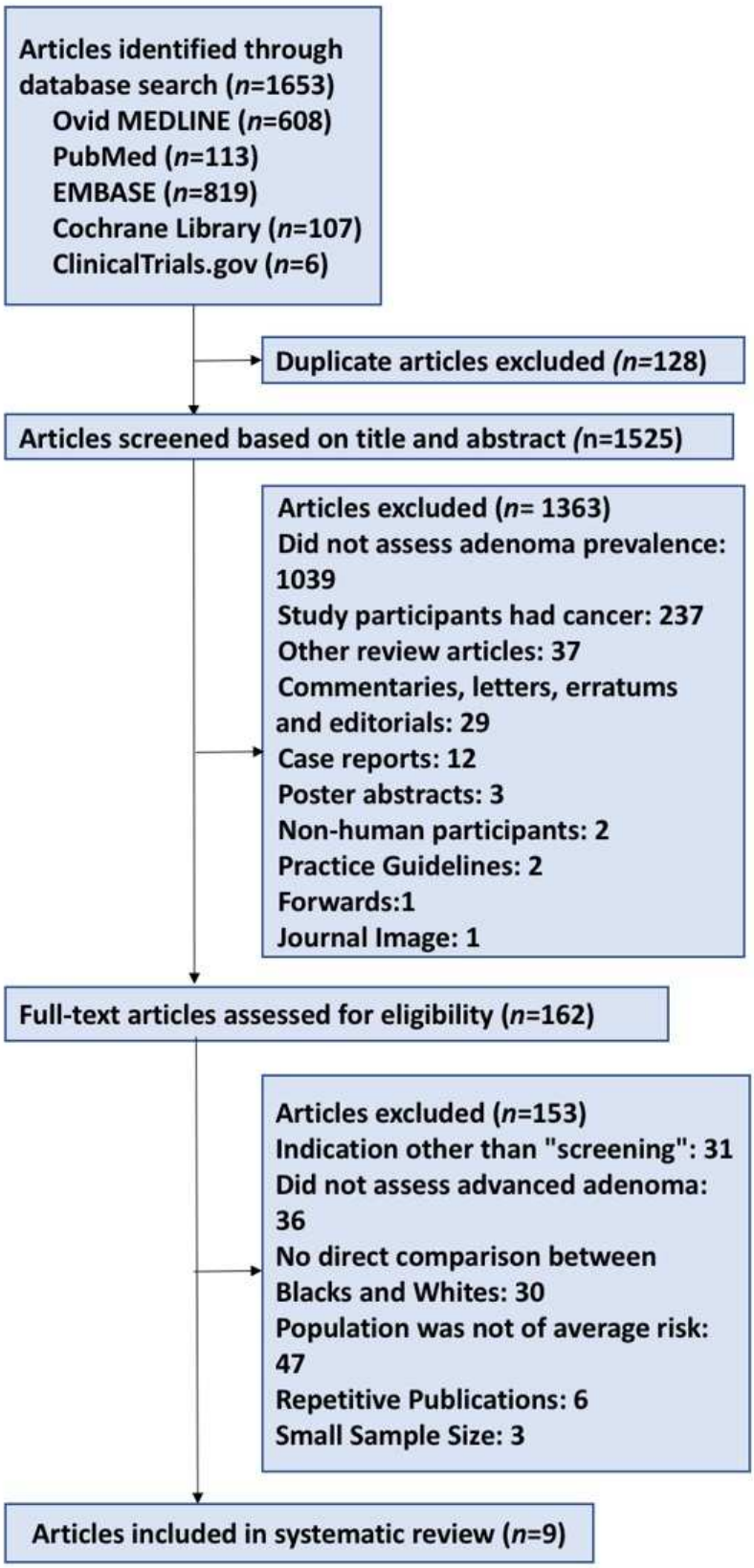
Articles identified through database search (n=1653)
Ovid MEDLINE (n=608)
PubMed (n=113)
EMBASE (n=819)
Cochrane Library (n=107)
ClinicalTrials.gov (n=6)
Duplicate articles excluded (n=128)
Articles screened based on title and abstract (n=1525)
Articles excluded (n= 1363)
Did not assess adenoma prevalence: 1039
Study participants had cancer: 237
Other review articles: 37
Commentaries, letters, erratums and editorials: 29
Case reports: 12
Poster abstracts: 3
Non-human participants: 2
Practice Guidelines: 2
Forwards:1
Journal Image: 1
Full-text articles assessed for eligibility (n=162)
Articles excluded (n=153)
Indication other than "screening": 31
Did not assess advanced adenoma: 36
No direct comparison between Blacks and Whites: 30
Population was not of average risk: 47
Repetitive Publications: 6
Small Sample Size: 3
Articles included in systematic review (n=9)

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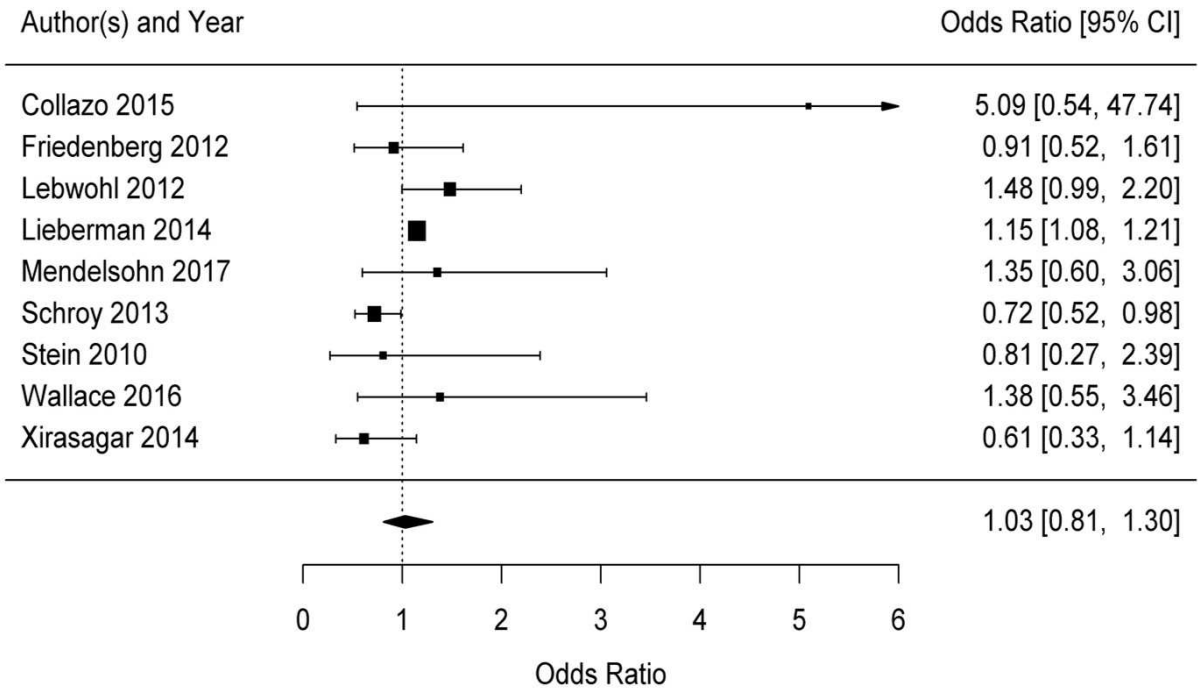

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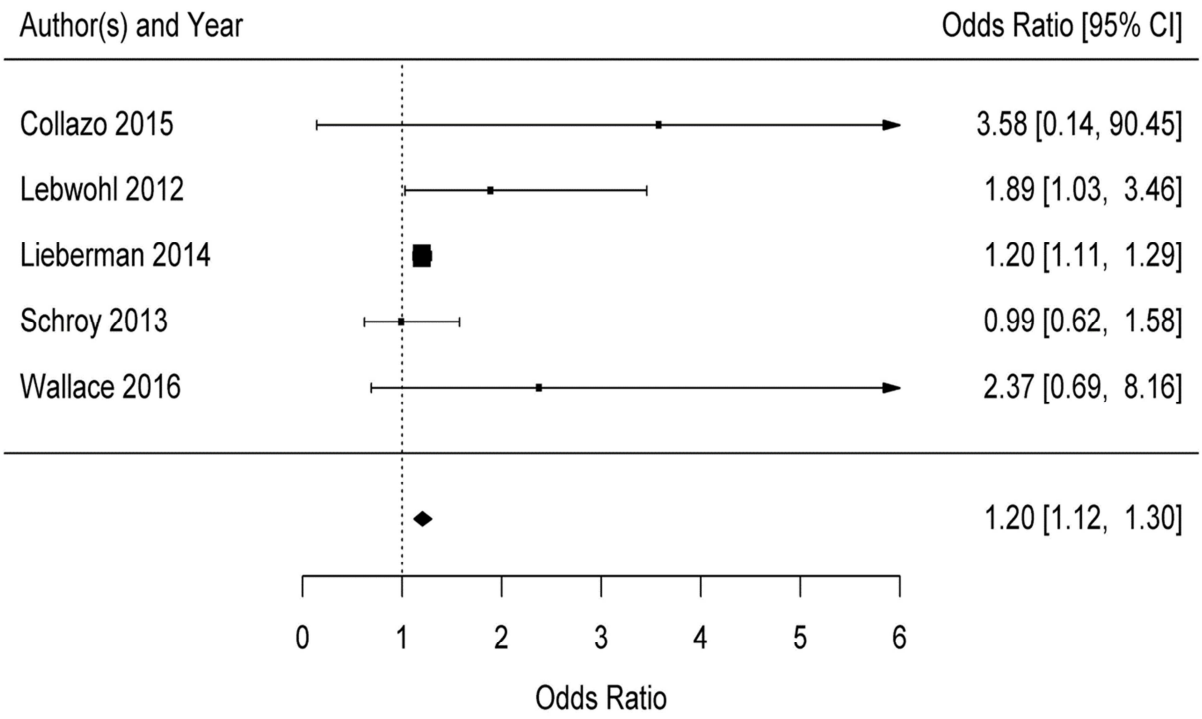
Author(s) and Year
Odds Ratio [95% CI]
Collazo 2015
3.58 [0.14, 90.45]
Lebwohl 2012
1.89 [1.03, 3.46]
Lieberman 2014
1.20 [1.11, 1.29]
Schroy 2013
0.99 [0.62, 1.58]
Wallace 2016
2.37 [0.69, 8.16]
1.20 [1.12, 1.30]
0
1
2
3
4
5
6
Odds Ratio

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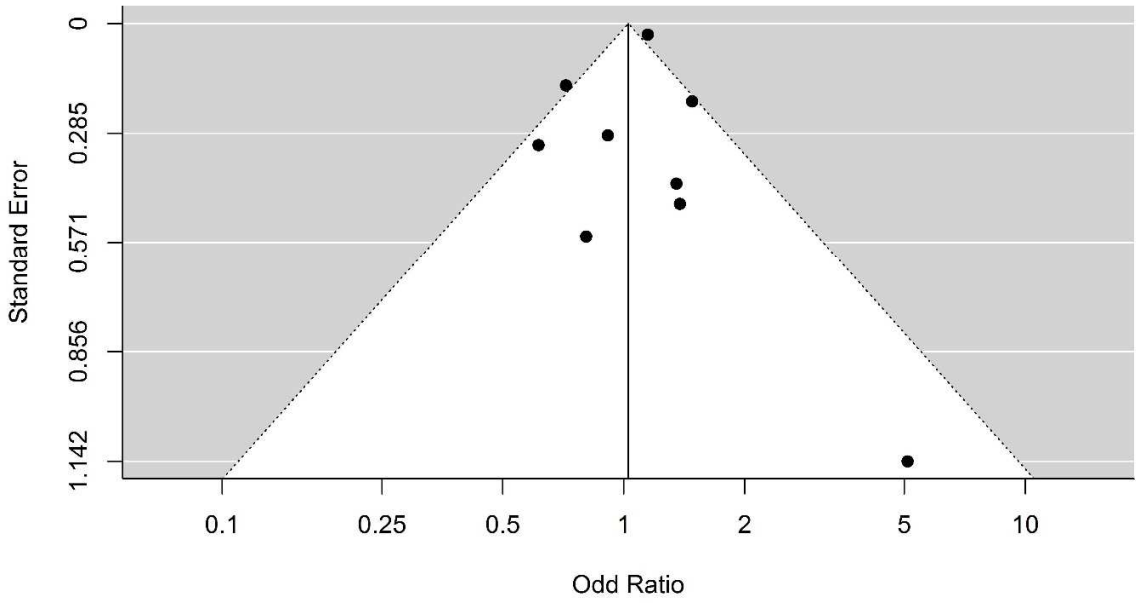

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Appendix: Detailed Search Strategies

MEDLINE (Ovid):

1	exp Colonic Polyps/
2	exp Cecal Diseases/ or exp Colonic Diseases/ or exp Rectal Diseases/
3	exp Intestine, Large/
4	exp Colonoscopy/
5	exp Adenomatous Polyps/
6	Adenoma/ or adenoma*.tw.
7	Precancerous Conditions/
8	exp Carcinoma in Situ/
9	(precancer* or pre cancer* or preneoplas* or pre neoplas* or premalignan* or pre malignan* or dysplas*).tw.
10	(advanced or size* or distribution* or location*).tw.
11	(cancer related or malignant transformation).tw.
12	Mass Screening/
13	exp "Early Detection of Cancer"/
14	(or/1-4) and (or/5-13)
15	exp African Continental Ancestry Group/
16	(black* or african american* or negro* or afro*).tw.
17	exp European Continental Ancestry Group/
18	(caucasian* or white*).tw.
19	exp *African Continental Ancestry Group/
20	(black* or african american* or negro* or afro*).ti.
21	((15 or 16) and (17 or 18)) or 19 or 20
22	14 and 21
23	limit 22 to english language
24	exp Animals/ not exp Humans/
25	23 not 24

PubMed (PubMed.gov):

#1	colon [tiab] OR colonic [tiab] OR colorectal [tiab] OR "colo rectal" [tiab] OR colonoscop* [tiab]
#2	adenoma* [tiab] OR precancer* [tiab] OR pre cancer* [tiab] OR preneoplas* [tiab] OR pre neoplas* [tiab] OR premalignan* [tiab] OR pre malignan* [tiab] OR dysplas* [tiab] OR screen* [tiab]
#3	advanced [tiab] OR size* [tiab] OR distribution* [tiab] OR location* [tiab] OR "cancer related" [tiab] OR "malignant transformation" [tiab] OR “carcinoma in situ” [tiab]
#4	black* [tiab] OR african american* [tiab] OR negro* [tiab] OR afro* [tiab]
#5	caucasian* [tiab] OR white* [tiab]
#6	black* [ti] OR african american* [ti] OR negro* [ti] OR afro* [ti]
#7	(#1 AND (#2 OR #3) AND ((#4 AND #5) OR #6)) Filters: English
#8	(#7 NOT medline [sb])

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EMBASE (Embase.com):

#1	'large intestine tumor'/exp
#2	'large intestine disease'/exp
#3	'large intestine'/exp
#4	'colonoscopy'/exp
#5	'colorectal carcinogenesis'/exp
#6	'colon adenomatosis'/exp
#7	'adenomatous polyp'/exp
#8	'precancer and cancer-in-situ'/exp
#9	'early cancer diagnosis'/exp
#10	precancer*:ti,ab OR (pre NEXT/1 cancer*):ti,ab OR preneoplas*:ti,ab OR (pre NEXT/1 neoplas*):ti,ab OR premalignan*:ti,ab OR (pre NEXT/1 malignan*):ti,ab OR dysplas*:ti,ab OR adenoma*:ti,ab
#11	advanced:ti,ab OR size*:ti,ab OR distribution*:ti,ab OR location*:ti,ab OR 'cancer related':ti,ab OR 'malignant transformation':ti,ab
#12	'cancer screening'/exp
#13	(#1 OR #2 OR #3 OR #4 OR #5 OR #6) AND (#7 OR #8 OR #9 OR #10 OR #11 OR #12)
#14	'black person'/exp
#15	black*:ti,ab OR (african NEXT/1 american*):ti,ab OR negro*:ti,ab OR afro*:ti,ab
#16	'caucasian'/exp
#17	caucasian*:ti,ab OR white*:ti,ab
#18	'black person'/exp/mj
#19	black*:ti OR (african NEXT/1 american*):ti OR negro*:ti OR afro*:ti
#20	((#14 OR #15) AND (#16 OR #17)) OR #18 OR #19
#21	#13 AND #20 AND [english]/lim

Cochrane Library (Wiley):

#1	(colon or colonic or colorectal or colo next rectal or colonoscop*):ti,ab,kw
#2	(precancer* or pre next cancer* or preneoplas* or pre next neoplas* or premalignan* or pre next malignan* or dysplas* or screen* or adenoma*):ti,ab,kw
#3	(advanced or size* or distribution* or location* or "cancer related" or "malignant transformation" or "carcinoma in situ"):ti,ab,kw
#4	(black* or african next american* or negro* or afro*):ti,ab,kw
#5	(caucasian* or white*):ti,ab,kw
#6	(black* or african next american* or negro* or afro*):ti
#7	#1 and (#2 or #3) and ((#4 and #5) or #6)